



# Hurricane

## Information and Atlantic Tracking Chart





# Hurricanes

**Hurricanes** are tropical cyclones in which winds reach speeds of 74 miles per hour or more, and blow in a large spiral around a relatively calm center—the eye of the hurricane. Every year, these violent storms bring destruction to coastlines and islands in their erratic path. Tropical cyclones of the same type are called typhoons in the North Pacific, baguios in the Philippines, and cyclones in the Indian Ocean.

Stated very simply, hurricanes are giant whirlwinds in which air moves in a large, tightening spiral around a center of extreme low pressure, reaching maximum velocity in a circular band extending outward 20 or 30 miles from the rim of the eye. This circulation is counterclockwise in the Northern Hemisphere, and clockwise in the Southern Hemisphere. Near the eye, hurricane winds may gust to more than 200 miles per hour, and the entire storm dominates the ocean surface and lower atmosphere over tens of thousands of square miles.

**The eye**, like the spiral structure of the storm, is unique to hurricanes. Here, winds are light and skies are clear or partly cloudy. But this calm is deceptive, bordered as it is by hurricane-force winds and torrential rains. Many persons have been killed or injured when the calm eye lured them out of shelter, only to be caught in the hurricane winds at the far side of the eye, where the wind blows from a direction opposite to that in the leading half of the storm.

**Hurricane winds do much damage, but drowning is the greatest cause of hurricane deaths.** As the storm approaches and moves across the coastline, it brings huge waves, raising tides some 15 feet or more above normal. The rise may come rapidly, and produce flash floods in coastal lowlands, or may come in the form of giant waves—which are mistakenly called “tidal waves”. Waves and currents erode beaches and barrier islands, undermine waterfront structures, and wash out highway and railroad beds. The torrential rains produce sudden flooding; as the storm moves inland and its winds diminish, floods constitute the hurricane’s greatest threat.

**The hurricanes that strike the eastern United States** are born in the tropical and subtropical North Atlantic Ocean, the Carib-

bean Sea, and the Gulf of Mexico. Most occur in August, September, and October, but the six-month period from June 1 to November 30 is considered the Atlantic hurricane season.

The principal regions of tropical cyclone origin vary during the season. Most early (May and June) storms originate in the Gulf of Mexico and western Caribbean. In July and August, the areas of most frequent origin shift eastward, and by September are located over the larger area from the Bahamas southeastward to the Lesser Antilles, and thence eastward to south of the Cape Verde Islands, near the west coast of Africa. After mid-September, the principal areas of origin shift back to the western Caribbean and Gulf of Mexico.

On average, six Atlantic hurricanes occur per year. However, there are significant deviations from this average. In 1916 and 1950, 11 hurricanes were observed, and no hurricanes were observed in 1907 and 1914. During 1893, 1950, and 1961 seasons, four hurricanes were observed in progress at the same time.

Hurricanes also form along the west coast of Mexico and Central America, but their effects are seldom felt as far north as California. These threaten shipping and aviation, however, and are watched as carefully as their Atlantic cousins.

**Hurricanes begin** as relatively small tropical cyclones which drift gradually to the west-northwest (in the Northern Hemisphere), imbedded in the westward-blowing tradewinds of the tropics. Under certain conditions these disturbances increase in size, speed, and intensity until they become full-fledged hurricanes.

The storms move forward very slowly in the tropics, and may sometimes hover for short periods of time. The initial forward speed is usually 15 miles per hour or less. Then, as the hurricane moves farther from the Equator, its forward speed tends to increase; at middle latitudes it may exceed 60 miles per hour in extreme cases.

The great storms are driven by the heat released by condensing water vapor, and by external mechanical forces. Once cut off from the warm ocean, the storm begins to die, starved for water and heat energy, and dragged apart by friction as it moves over the land.



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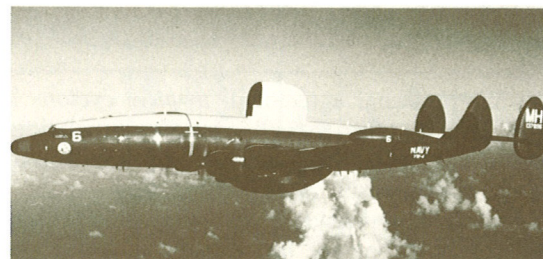
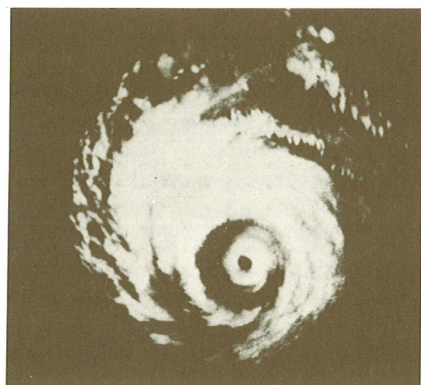
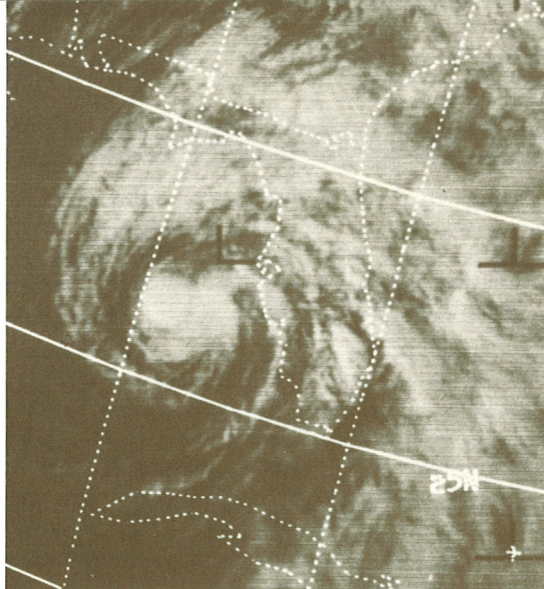
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## The National Weather Service's Work of Timely Warning

During summer and autumn, the Atlantic Hurricane Warning Service, headquartered at the National Hurricane Center in Miami, and Weather Service Hurricane Warning Offices at San Juan, New Orleans, Washington, and Boston maintain a constant watch for tropical disturbances which could develop into destructive storms. A similar effort, headquartered at Weather Service Offices in San Francisco and Honolulu, counters the threat of Pacific hurricanes.

Hemispheric summaries from the National Meteorological Center in Maryland, cloud photographs and other data from satellites, ship and aircraft reports, measurements from a network of weather stations monitor the disturbance. When it appears that a storm is developing, an Air Force or Navy reconnaissance aircraft or one of the aircraft of NOAA's Research Flight Facility is sent to the area to make a thorough investigation. Temperature, pressure, and wind readings are taken, cloud structure is observed, and the extent, movement, and position of the storm are noted. These are hurricane hunter flights, when pilots

pit their machines and skill against the brutal forces within a hurricane. Additional reports are received from ships at sea and island weather stations.

As the storm approaches the Atlantic mainland, the Weather Service's radar fence picks up and tracks its movement. This buffer is a line of overlapping weather radars from Texas to New England, each station having a range of about 200 miles. Because hurricanes are also creatures of the sea, a watch is kept on tidal heights in the path of the storm. Weather Service offices are linked through telemetry to NOAA National Ocean Survey tide gages. Under normal conditions, the tidal record (marigram) is a gentle, continuous oscillation; but the swells which precede hurricanes, storm surges during the final approach and passage of the hurricane, and wave action caused by hurricane winds appear as sharp discontinuities in the tidal record. This link between weathermen and automatic tide stations is an important element in forecasting the arrival and destructive potential of storm surges and hurricane waves.



# TERMS TO KNOW

By international agreement, *tropical cyclone* is the general term for all cyclonic circulations originating over tropical waters, classified by form and intensity as follows:

**Tropical disturbance:** rotary circulation slight or absent at surface but sometimes better developed aloft, no closed isobars (lines of equal atmospheric pressure) and no strong winds, a common phenomenon in the tropics.

**Tropical depression:** one or more closed isobars and some rotary circulation at surface, highest wind speed 39 miles per hour (34 knots).

**Tropical storm:** closed isobars, distinct rotary circulation, highest wind speed 39-73 miles per hour (34-63 knots).

**Hurricane:** closed isobars, strong and very pronounced rotary circulation, wind speed of 74 miles per hour (64 knots) or more.

**Small-craft warning:** When a hurricane moves within a few hundred miles of the coast, advisories warn small-craft operators to take precautions and not to venture into the open ocean.

**Gale warning:** When winds of 38-55 miles per hour (33-48 knots) are expected, a gale warning is added to the advisory message.

**Storm warning:** When winds of 55-74 miles per hour (48-64 knots) are expected, a storm warning is added to the advisory message. Gale and storm warnings indicate the coastal area to be affected by the warning, the time

during which the warning will apply, and the expected intensity of the disturbance. *When gale or storm warnings are part of a tropical cyclone advisory, they may change to a hurricane warning if the storm continues along the coast.*

**Hurricane watch:** If the hurricane continues its advance and threatens coastal and inland regions, a hurricane watch is added to the advisory, covering a specified area and duration. A hurricane watch means that hurricane conditions are a real possibility; it does *not* mean they are imminent. When a hurricane watch is issued, everyone in the area covered by the watch should listen for further advisories and be prepared to act quickly if hurricane warnings are issued.

**Hurricane warning:** When hurricane conditions are expected within 24 hours, a hurricane warning is added to the advisory. Hurricane warnings identify coastal areas where winds of at least 74 miles per hour are expected to occur. A warning may also describe coastal areas where dangerously high water or exceptionally high waves are forecast, even though winds may be less than hurricane force.

When the hurricane warning is issued, all precautions should be taken immediately. Hurricane warnings are seldom issued more than 24 hours in advance. If the hurricane's path is unusual or erratic, the warnings may be issued only a few hours before the beginning of hurricane conditions. Precautionary actions should begin as soon as a hurricane warning is announced.

## TROPICAL CYCLONE NAMES

In 1971 the National Weather Service prepared a semi-permanent list of ten sets of tropical storm names in alphabetical order. Names beginning with Q, U, X, Y, and Z were not included because of their scarcity.

A separate set of names is used each year, beginning with the first name in each set. The names of particular individuals have not been chosen for inclusion on these sets of names

1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Arlene	Agnes	Alice	Alma	Amy	Anna	Anita	Amelia	Angie	Abby
Beth	Betty	Brenda	Becky	Blanche	Belle	Babe	Bess	Barbara	Bertha
Chloe	Carrie	Christine	Carmen	Caroline	Candice	Clara	Cora	Cindy	Candy
Doria	Dawn	Delia	Dolly	Doris	Dottie	Dorothy	Debra	Dot	Dinah
Edith	Edna	Ellen	Elaine	Eloise	Emmy	Evelyn	Ella	Eve	Elsie
Fern	Felice	Fran	Fifi	Faye	Frances	Frieda	Flossie	Franny	Felicia
Ginger	Gerda	Gilda	Gertrude	Gladys	Gloria	Grace	Greta	Gwyn	Georgia
Heidi	Harriet	Helen	Hester	Hallie	Holly	Hannah	Hope	Hedda	Hedy
Irene	Ilene	Imogene	Ivy	Ingrid	Inga	Ida	Irma	Iris	Isabel
Janice	Jane	Joy	Justine	Julia	Jill	Jodie	Juliet	Judy	June
Kristy	Kara	Kate	Kathy	Kitty	Kay	Kristina	Kendra	Karen	Kim
Laura	Lucile	Loretta	Linda	Lilly	Lilias	Lois	Louise	Lana	Lucy
Margo	Mae	Madge	Marsha	Mabel	Maria	Mary	Martha	Molly	Millie
Nona	Nadine	Nancy	Nelly	Niki	Nola	Nora	Noreen	Nita	Nina
Orchid	Odette	Ona	Olga	Opal	Orpha	Odel	Ora	Ophelia	Olive
Portia	Polly	Patsy	Pearl	Peggy	Pamela	Penny	Paula	Patty	Phyllis
Rachel	Rita	Rose	Roxanne	Ruby	Ruth	Raquel	Rosalie	Roberta	Rosie
Sandra	Sarah	Sally	Sabrina	Sheila	Shirley	Sophia	Susan	Sherry	Suzy
Terese	Tina	Tam	Thelma	Tilda	Trixie	Trudy	Tanya	Tess	Theda
Verna	Velma	Vera	Viola	Vicky	Vilda	Virginia	Vanessa	Vesta	Violet
Wallis	Wendy	Wilda	Wilma	Winnie	Wynne	Willene	Wanda	Wenda	Willette



# How to Track a Hurricane

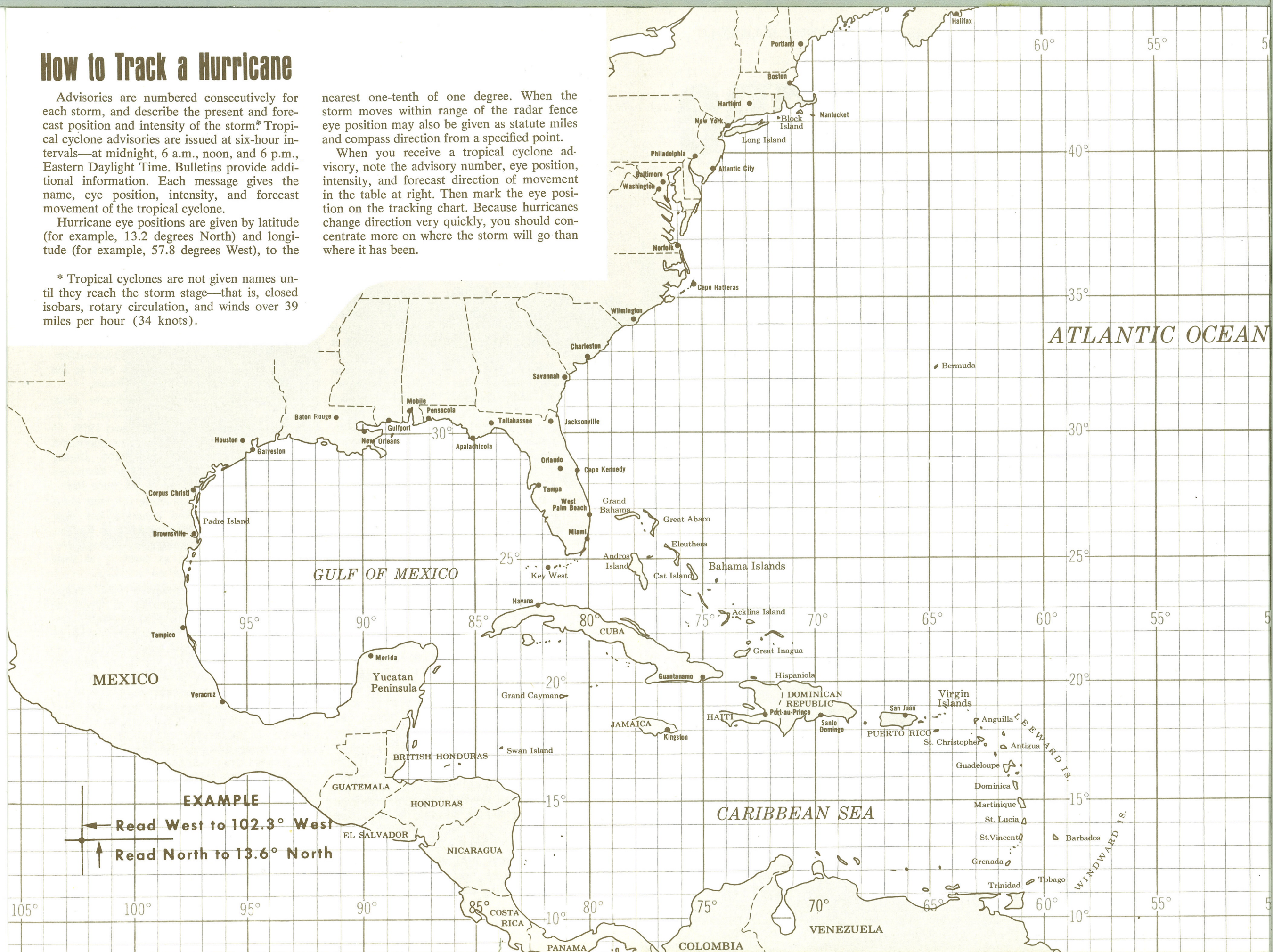
Advisories are numbered consecutively for each storm, and describe the present and forecast position and intensity of the storm.\* Tropical cyclone advisories are issued at six-hour intervals—at midnight, 6 a.m., noon, and 6 p.m., Eastern Daylight Time. Bulletins provide additional information. Each message gives the name, eye position, intensity, and forecast movement of the tropical cyclone.

Hurricane eye positions are given by latitude (for example, 13.2 degrees North) and longitude (for example, 57.8 degrees West), to the

nearest one-tenth of one degree. When the storm moves within range of the radar fence eye position may also be given as statute miles and compass direction from a specified point.

When you receive a tropical cyclone advisory, note the advisory number, eye position, intensity, and forecast direction of movement in the table at right. Then mark the eye position on the tracking chart. Because hurricanes change direction very quickly, you should concentrate more on where the storm will go than where it has been.

\* Tropical cyclones are not given names until they reach the storm stage—that is, closed isobars, rotary circulation, and winds over 39 miles per hour (34 knots).









# HURRICANE SAFETY RULES

Hurricane advisories will help you save your life . . . but you must help.

Follow these safety rules during hurricane emergencies:

1. **Enter each hurricane season prepared.** Every June through November, recheck your supply of boards, tools, batteries, nonperishable foods, and the other equipment you will need when a hurricane strikes your town.
2. **When you hear the first tropical cyclone advisory,** listen for future messages; this will prepare you for a hurricane emergency well in advance of the issuance of watches and warnings.
3. **When your area is covered by a hurricane watch,** continue normal activities, but stay tuned to radio or television for all National Weather Service advisories. Remember, a hurricane watch means possible danger within 24 hours; if the danger materializes, a hurricane warning will be issued. Meanwhile, keep alert. Ignore rumors.
4. **When your area receives a hurricane warning:**  
**Plan your time** before the storm arrives and avoid the last-minute hurry which might leave you marooned, or unprepared.  
**Keep calm** until the emergency has ended.  
**Leave low-lying areas** that may be swept by high tides or storm waves.  
**Leave mobile homes** for more substantial shelter. They are particularly vulnerable to overturning during strong winds. Damage can be minimized by securing mobile homes with heavy cables anchored in concrete footing.  
**Moor your boat securely** before the storm arrives, or evacuate it to a designated safe area. When your boat is moored, leave it, and don't return once the wind and waves are up.  
**Board up windows** or protect them with storm shutters or tape. Danger to small windows is mainly from wind-driven debris. Larger windows may be broken by wind pressure.  
**Secure outdoor objects** that might be blown away or uprooted. Garbage cans, garden tools, toys, signs, porch furniture, and a number of other harmless items become missiles of destruction in hurricane winds. Anchor them or store them inside before the storm strikes.  
**Store drinking water** in clean bathtubs, jugs, bottles, and cooking utensils; your town's water supply may be contaminated by flooding or damaged by hurricane floods.  
**Check your battery-powered equipment.** Your radio may be your only link with the world out-

side the hurricane, and emergency cooking facilities, lights, and flashlights will be essential if utilities are interrupted.

**Keep your car fueled.** Service stations may be inoperable for several days after the storm strikes, due to flooding or interrupted electrical power.

**Stay at home,** if it is sturdy and on high ground; if it is not, move to a designated shelter, and stay there until the storm is over.

**Remain indoors during the hurricane.** Travel is extremely dangerous when winds and tides are whipping through your area.

**Monitor the storm's position** through National Weather Service advisories.

## Beware the Eye of the Hurricane

If the calm storm center passes directly overhead, there will be a lull in the wind lasting from a few minutes to half an hour or more. Stay in a safe place unless emergency repairs are absolutely necessary. But remember, at the other side of the eye, the winds rise very rapidly to hurricane force, and come from the opposite direction.

5. **When the hurricane has passed:**  
**Seek necessary medical care** at Red Cross disaster stations or hospitals.  
**Stay out of disaster areas.** Unless you are qualified to help, your presence might hamper first-aid and rescue work.  
**Drive carefully** along debris-filled streets. Roads may be undermined and may collapse under the weight of a car. Slides along cuts are also a hazard.  
**Avoid loose or dangling wires,** and report them immediately to your power company or the nearest law enforcement officer.  
**Report broken sewer or water mains** to the water department.  
**Prevent fires.** Lowered water pressure may make fire fighting difficult.  
**Check refrigerated food** for spoilage if power has been off during the storm.
- Remember that hurricanes moving inland can cause severe flooding.** Stay away from river banks and streams.

Tornadoes spawned by hurricanes are among the storms' worst killers. When a hurricane approaches, listen for tornado watches and warnings. A tornado watch means tornadoes are expected to develop. A tornado warning means a tornado has actually been sighted. When your area receives a tornado warning, seek inside shelter immediately, preferably below ground level. If a tornado catches you outside, move away from its path at a right angle. If there is no time to escape, lie flat in the nearest depression, such as a ditch or ravine.

**HURRICANE WATCHES MEAN A HURRICANE MAY THREATEN AN AREA WITHIN 24 HOURS.**

**HURRICANE WARNINGS MEAN A HURRICANE IS EXPECTED TO STRIKE AN AREA WITHIN 24 HOURS**

